USING STUDENT SELF-ASSESSMENTS OF LEARNING OBJECTIVES AS A PROGRAM MANAGEMENT TOOL

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1. INTRODUCTION

1.1 Abstract

The Interprofessional Projects (IPRO®) Program at our private, midsize, midwestern university provides a required six credit project-based learning experience designed to provide undergraduate students an opportunity to improve skills identified as crucial by ABET and future employers. While each project in this program has a distinct focus, (see appendix 1, 2 and 3), the meta-objectives for all projects involve strengthening multidisciplinary teamwork, communication, project management, and problem solving skills, as well as immersing students in an environment that will enhance life-long learning and increase awareness of societal, professional and ethical issues. While these are laudable learning objectives, it is challenging to determine the best way to assess whether these objectives are being met. Our university is developing a multifaceted assessment system to measure the achievement of these learning objectives, provide students an opportunity to reflect on their accomplishments, and identify program improvements. Currently the main components of the assessment system are three regularly scheduled student surveys, two tests of knowledge acquisition, independent professional judging of team performance and two facilitated discussion sessions.

In this paper data gathered from Fall 2003, Spring 2004, Fall 2004, and Spring 2005 semesters from a student assessment survey administered at the end of the semester is analyzed and correlated with other assessment data. The principal analyses are 1) consistency in self-report assessments of learning objectives over the three time periods; and 2) correlations between self-reporting and independent judge evaluations of team performance and outcomes. The principal research hypothesis is that students are able to determine the value of their learning experiences and that their student assessment survey is a valid measure of the quality of individual projects and, therefore, the Interprofessional Projects (IPRO®) Program as a whole. If true, the student

assessment data can then be used in project selection and design, faculty selection and oversight, and overall assessment of the quality of the IPRO program over time.

1.2 Overview of the program

As cross-functional teams have become more prevalent within professional work environments, so have interdisciplinary project-based teams in academic environments. More institutions of higher education have been incorporating interdisciplinary education into their curricula. Common goals of these programs have been: continual development of communication and multidisciplinary teamwork skills; multidisciplinary exchange to create a marketable product/service (McKeage, et el., 1999); development of interpersonal relationships, crisis management, and objectivity while improving written, oral, and presentation communication skills (Bhavnan, et el., 1996); developing time management awareness, commitment to a company, and job search skills (Howerton, Charles P., 1988); solving a real-life engineering problem in a team environment (Banios, Edward W., 1992); and teaching students the project management skills of proposing, planning, and control.

The IPRO Program is designed to provide students with practical experience that reinforces their theoretical knowledge. This is accomplished through problem solving within a multidisciplinary team environment (Jacobius, Thomas M. 2002). In doing so, we believe that our students develop greater confidence in themselves, hone leadership skills, learn to respect and value different cultural and analytical perspectives, and improve teamwork, communication, and project management skills. IPRO Projects are based on real-world problems, often involving sponsors that reflect the diversity of the workplace: corporations, entrepreneurial ventures, non-profit organizations, and government agencies. The projects cover a broad range of topics and include, research, design, process improvement and business feasibility or planning assignments.

About 85% of enrolled IPRO students are juniors or seniors, though sophomores and graduate students also enroll in the courses. A majority of these students are majoring in engineering, architecture and computer science, but the program also involves undergraduate students from the physical sciences, social sciences, humanities, psychology, and business. Each semester the program registers 300 to 400 students across 30 to 40 teams and team sizes range from 7 to 15 students with a mean of 12 students per team.

Over the ten years since 1995 that IPRO courses have been offered, no systematic measurement of the attainment of learning objectives was conducted. However, learning objectives assessment plans for academic project based initiatives have been published. Schmahl and Noble (2002) discuss twelve methods developed and implemented as a part of an overall assessment plan and such assessment techniques are implemented at other universities. However, the use of self-reporting instruments as described by Immekus, Jason C et al. (2004) is more relevant to this aspect of our assessment initiative and we have in part modeled our self-reporting measurement architecture after their conceptual approach.

1.3 Background and Development of the Student Assessment Survey Instrument

The student assessment survey was created initially to reflect five learning objectives of the IPRO Program: multidisciplinary teamwork, communication, project management, real-world problem solving, and continuous learning and the skills or behavior implied by these objectives. These learning objectives were established in Fall 2003 by reading all the faculty strategy reports and evaluations of the IPRO program that had been produced over its previous 8 years. Then, through a series of faculty and staff meetings, acceptance of their definition was achieved. (A brief description of these initial statements of the learning objectives and skills/behaviors can be seen in Table A below). In the spring of 2004 based on student assessment survey data collected in fall 2003, a confirmatory factor analysis was conducted using the statistics software package, LISREL (Jöreskog and Sörbom, 1996). The results of this analysis indicated that students were not rating student assessment survey items based on the five individual learning objectives. Rather, the students were rating items based on an interaction of the initial five learning objectives that indicated that only four factors were actually being consistently measured (Aragaki et al., 2005).

TABLE A: Description of initial statements of the learning objectives

1. Multidisciplinary Teamwork
    a. Team includes students from 2 or more disciplines.
    b. Team members are considered specialists in their areas of expertise.
    c. Team has a common goal and members work together to achieve that objective.
2. Communication
    a. Teams communicate effectively both through writing and verbally.
    b. Team members are able to structure their communications in a way that makes it easy for others to understand them.
    c. Team members contribute to discussions so that all opinions are voiced and heard.
3. Project Management
    a. Team is able to efficiently manage its time.
    b. Each team member is responsible for at least one task.
    c. Tasks are delegated fairly and efficiently.
4. Continuous Learning
    a. Team members are interested enough in the project and the tasks involved to use this project as a stepping stone for future endeavors.
    b. Team members are interested in continuing to learn more about the project topic and are willing to continue with the same project over multiple semesters.
    c. Team members initiate learning activities with little or no prompting.
5. Real World Problem Solving
    a. Project and tasks involved are ones that are done commonly in the workplace. Similar problems occur as they would in a workplace environment.
    b. Caliber of tasks is at a professional level and are performed professionally.
    c. Proper ethical procedures are discussed regarding major tasks or objectives.

Although the Fall 2003 student assessment survey data fit with a four-factor structure, there were several questions or survey items that did not correlate with any of the new factors.. At this point, twelve of forty original student assessment survey questions were dropped from the survey, items with strong correlations to the new factors were retained and 12 new questions were added. Data was then collected from this new student assessment survey in spring 2004, fall 2004, and spring 2005. Over the three semesters there are 31 questions, which have been administered continuously to over 100 IPRO project teams. See appendix 4 for a list of 31 survey items used in this analysis. With three additional semesters of survey data in hand, analysis was then conducted to determine if the instrument is reliable and stable across semesters and if the survey results correlate positively with other independent measures of team and learning objective performance.

1.3 Background and Development of the IPRO Projects Day Judging Process

Each semester all IPRO teams are required to prepare both a 20-minute oral presentation and an exhibit staffed for 6 hours, which discusses their semester's achievements [See appendices 1 and 2 for IPRO Day Conference programs for Spring 2004 and Spring 2005]. Cash awards are given to teams who in the eyes of the judges have best met the goals of the IPRO program. Independent professional judges are recruited, trained and given judging sheets to use to evaluate the work of the teams. The judging teams have an appointed coordinator or chief judge who organizes the work of the judging teams and ensures consistency and fairness across the 4-8 teams assigned to each 3-7 person judging team. Before the development of the learning objectives the judging forms were focused primarily on communication skills and project outcomes. For the spring of 2004 and subsequent semesters the judging forms were revised to better match the learning objectives, chief judges were established to coordinate the judging process and the judges training was initiated.[see appendices 5 and 6 for IPRO Day judging forms]. Entrepreneurial projects have differentiated judging forms to reflect the unique nature of their projects but currently no other types of IPRO s have a differentiated judging process. A significant percentage of judges, who are drawn from faculty, staff, industry and graduate students, are repeat judges. Only faculty or experienced judges are used as chief judges of the judging teams. An example of judging results for an IPRO Day is included in appendix 7.

2. METHODS

2.1 Method for student assessment survey

For evaluating the consistency of the student assessment survey, exploratory factor analysis was first conducted for each semester. to determine the factor structure model. For each semester, the criteria used to determine the number of factors to rotate was the a priori hypothesis that the current survey has items that load on a four-factor structure, the scree plot, and the interpretability of the factor solution. The scree plot indicated that the survey might have three, then four factors. Missing data was dealt with by excluding cases through pair wise comparison. The analysis yielding the cleanest pattern of results was principle axis factor analysis designating four factors.

Based on interpretability, the factors were rotated using Varimax rotation. The solution after rotation was obtained in seven iterations. The factors identified for each semester are shown in table B.

Table B: Factors identified from Student self-assessment surveys.

Semester	Factors Identified
Fall 2003	Teamwork processes Continuous learning Task completion Communication
Spring 2004	Teamwork processes Continuous learning Task completion Communication
Fall 2004	Teamwork processes Continuous learning Task completion Standards of Behavior
Spring 2005	Teamwork processes Continuous learning Task completion Standards of Behavior

2.2 Method for IPRO Day Judging

IPRO Day judging commences with the recruitment of experienced judges some 60 days before the scheduled conference day, continues with information and instructions provided to the judges and concludes with on-site training and judging on IPRO Day. Each team presentation and exhibit is judged by a team of three-seven judges using criteria that have been matched to the learning objectives, under the supervision of a chief judge tasked with maintaining fairness and consistency. Rubrics are provided which help define expected behavior and questions and other judging aids are discussed and provided to guide the judging process. Each team is judged in a session that lasts 30-45 minutes and consists of a presentation by members of the project team as well as questioning by the judges. There is a formal team presentation which accounts for 50% of the IPRO Day score and an interactive discussion at the team exhibit which accounts for the other 50% of the IPRO Day score [see appendix 7]. Teams compete against teams with similar problems or in a track. Judges are assigned only to one track for either presentations or exhibits and the judges' scores are averaged to arrive at a team score for presentations or exhibits.

2.3 Comparison of Student Team Assessment Scores

Student team assessment scores are compiled by taking the mean score for items related by the factor analysis for each team and grouping them by factor by team as shown for Spring 05 in appendix 8. For IPRO team 301 in Spring 2005, Factor 1 or Teamwork processes is a mean score

[3.67 out of 5.0] of all students on the team for all questions statistically grouped with that factor. The total in column five in appendix 7 is the sum of the four factor scores, F1-F4. The compare column normalizes the factor score to make it comparable to the total IPRO Day score with the formula total/20*200 for display of comparable scores with IPRO Day scores.

3. RESULTS

3.1 Discussion of Analysis Results for the Student Assessment Survey

There appears to be a reasonably stable factor structure. The questions items related to the factors in the surveys were then compared to determine the consistency of item correlations across semesters. The results, however, indicate that the factor structure is not completely stable across semesters. As shown in table E there are several possible reasons for this instability semester to semester which have not yet been identified formally but there are also a small core of survey items which have remained correlated [stable] against factors over the study period. These items are shown in table F.

Table E: Mapping of correlated survey items against factors across semesters

Spring 04			
Factor 1	**Factor 2**	**Factor 3**	**Factor 4**
Teamwork processes	**Continuous learning**	**Task completion**	**Communication**
Q1	**Q2**	**Q9**	**Q29**
Q8	**Q3**	**Q18**	**Q30**
Q13	**Q4**	**Q20**	
Q14	**Q5**	**Q22**	
Q15	**Q6**	**Q24**	
Q17	**Q7**	**Q25**	
Q19	**Q10**	**Q26**	
Q21	**Q11**	**Q27**	
Q23	**Q12**		
Q28	**Q16**		
Q31			

Fall 04			
Factor 1	Factor 2	Factor 3	Factor 4
Teamwork processes	Continuous learning	Task completion	Standards of Behavior
Q1	Q2	Q3	Q6
Q8	Q4	Q11	Q16
Q13	Q5	Q18	Q22
Q15	Q7	Q20	Q25
Q17	Q9	Q29	Q28
Q19	Q10	Q30	Q31
Q21	Q12		
Q23	Q14		
	Q24		
	Q26		
	Q27		

Spring 05			
Factor 1	Factor 2	Factor 3	Factor 4
Teamwork processes	Continuous learning	Task completion	Standards of Behavior
Q1	Q2	Q3	Q5
Q6	Q10	Q4	Q7
Q8	Q12	Q11	Q9
Q15	Q13	Q18	Q14
Q17	Q16	Q20	Q26
Q19	Q28	Q22	
Q21		Q24	
Q23		Q25	
		Q27	
		Q29	
		Q30	
		Q31	

Table F: Questions that overlap in Spring 04, Fall 04 and Spring 05

Factor 1	**Factor 2**	**Factor 3**	**Factor 4**
Teamwork Processes	**Continuous Learning**	**Task Completion**	**Standards of Behavior**
Q1	**Q2**	**Q18**	
Q8	**Q10**	**Q20**	
Q15	**Q12**	**Q22**	
Q17	**Q16**	**Q24**	
Q19		**Q25**	
Q21		**Q27**	
Q23			

It was expected that the survey items would cluster more clearly and consistently under the aforementioned four factors listed in Spring 2004. However, this is not always the case. Instead some groupings of items are scattered across the different learning objectives. For example, in the Spring 04, analysis, Item #5, "Opinions voiced by team members were treated with respect" is grouped under the factor, Teamwork Processes, whereas it was clustered more appropriately under Standards of Behavior in Spring 05. These results suggest the hypothesis that the students experience the various aspects of the learning objectives together and that achievement of one learning objective could be dependent on achievement of another learning objective or affected by events or variables not yet considered. In other words, rather than learning about the constructs (factors) individually, the students may learn about them through interacting in real situations where these factors are not all differentiated.

3.2 Discussion of Analysis Results for the comparison by team of the Student Assessment Survey and IPRO Day results

Correlation coefficients were computed among the four factors, team processes, continuous learning, task completion and standards of behavior and presentation, exhibit, and overall judge scores for the three semesters. The results of the analysis are presented in Table G for Spring 2005 and two other semesters. They show that the correlation between task completion (factor 3) and presentation scores, and task completion and overall judge scores in Spring 2005 were greater than or equal to .39 and were statistically significant at the .05 level. The correlations of the other factors were moderate but not significant. In general, the results suggest that overall self-ratings of the effectiveness of the program are correlated with overall judge scores as shown by the correlations shown for Fall 2004. If, on the other hand, the self-ratings are broken down between the learning objectives, the teams who value the importance of task completion tend to get higher overall judge scores and higher ratings on the team presentation.

Table G: Correlations between Student Self Assessment Scores and IPRO Day Judging Scores

	Assessment Factors	**Correlation to IPRO Day Presentation Scores**	**Correlation to IPRO Day Exhibit Scores**	**Correlation to IPRO Day Presentation + Exhibit Scores**
Spring 2004				
Factor 1	Teamwork Processes			
Factor 2	Continuous Learning		**.569**	**.511**
Factor 3	Task completion	**.397**		
Factor 4	Communication		**.335**	**.330**
Fall 2004				
Factor 1	Teamwork Processes			
Factor 2	Continuous Learning			
Factor 3	Task completion			
Factor 4	Standards of Behavior			
	Mean of all Factor Scores	**.519**		**.444**
Spring 2005				
Factor 1	Teamwork Processes	**.364**		
Factor 2	Continuous Learning			
Factor 3	Task completion	**.465**		**.387**
Factor 4	Standards of Behavior			

4. SUMMARY AND CONCLUSIONS

The IPRO program aims to build ethical, teamwork/communication and project management skills (rather than just technical expertise) in undergraduate students that enhance their performance in project based real-world work settings. The current student assessment survey instrument was designed to measure students' perception of the achievement of these learning objectives. Factor analysis of student assessment survey data indicate that students have a different evaluation structure than the stated learning objectives and evaluate their IPRO experience in terms of teamwork/communication processes, continuous learning, task completion and standards of behavior. Further, correlating the absolute scores of student assessments by IPRO team and IPRO Day team results provided by independent professional judges, has shown that only the student assessment survey factor, *task completion*, correlates well with IPRO Day judging scores.

The first conclusion is that the survey instrument appears stable enough to use as one tool to measure results by team and judge the quality of the learning experience for which both the program and the faculty are held responsible. However, non-correlated items should be removed from the survey and any comparisons across teams should be based upon the evaluation factors students actually use rather than a prior selection of learning objectives survey items, which in fact do not appear to be related in student minds. This conclusion is significant to all engineering educators as it implies that they can ask their students to evaluate the attainment of learning objectives [and expect valid results] but also must check whether the faculty's ideas for what is being measured are consistent with what the students are actually measuring.

Differences in factor results across semesters also suggest that further [or continuing] evaluation of the student assessment survey instrument and the measurement architecture is necessary. It is possible that a more stable and reliable student assessment instrument will result from survey items better mapped to the skills or behavior expected from attaining the learning objectives as is suggested by Immekus, Jason C et.al. (2004). A new measurement architecture initiative is therefore recommended.

A second conclusion is that the IPRO Day judging and the efforts of IPRO teams to perform for IPRO Day seem focused on 'task completion' or "what have we done that we can discuss with the judges? " rather than the broader set of factors reflected in the self assessment results and learning objectives. An examination and revision of the IPRO Day judging criteria and a mapping of those criteria against the learning objectives and the factors that students actually measure in their self assessment will potentially bring about more reinforcement of student learning through the IPRO Day Judging process. This conclusion is significant to all engineering educators as it implies that student poster sessions and student team competitions can certainly reinforce the attainment of learning objectives, but only if the judging process is attuned to and measuring skills and behavior that are related to the learning objectives.

The findings from this research are important for all programs striving to provide meaningful education in support of the ABET meta-objectives and concerned about determining how well their learning objectives are being achieved. These findings have confirmed the potential

effectiveness of the student self-assessment survey and resulted in a recommendation to continue it's use in program management providing attention is paid to maintaining a reliable instrument over time. These findings have also highlighted the need to map learning objectives against activities that involve competitions or judging processes so as to maximize their impact on the attainment of those learning objectives.

5. REFERENCES

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Appendix 1: IPRO Project Day Schedule, Spring 2004

Judges Breakfast Orientation 745AM in Ballroom		Track 0	Track 1	Track 2	Track 3	Track 4	Track 5	Track 6
		Technology Discussion	Transportation Systems	Energy and Environment	Computer Based Information Systems and Processes	Communications, Education, Government	Electrical-Mechnical Systems and Applied Sciences	New Venture Analysis
Session		**Ballroom**	**Faculty Dining Room**	**Room 007**	**Trustee Dining Room**	**Ballroom**	**Hermann Lounge**	**Alumni Lounge**
1 8:30-9:30				IPRO 310: The 2003 Northeast US Power Blackout		IPRO 316: Interdisciplinary Robotics Education Initiative	IPRO 324: Building a Garage Door Simulator and Data Acquisition System	EnPRO 359: A Gallery for Exhibiting Student, Faculty, Staff, and Alumni Art
2 9:15 - 9:45			IPRO 307: Automated Shipping Container Transportation	IPRO 301: Solar Hydrogen Hybrid System	IPRO 311: Planning IIT's Future Local Area Network (LAN) Cabling System	IPRO 320: Applying Interprofessional Thinking to the IIT Student Newspaper	IPRO 302: Low-Cost High Efficiency Heat Driven Refrigeration System	EnPRO 360: On-Campus Segway HT Rental and Tour Business
3 10:00 - 10:30			IPRO 304x: Hybrid Electric People Transporter (HEPT)	IPRO 323: Energy - and Environment-Based Architectural R&D	IPRO 338: Building a Knowledge Management System	IPRO 322: An Operations and Marketing Plan for WIIT	IPRO 308: Preventing the Collision of Birds with Windows	EnPRO 303: Portable System to Generate Potable Water and Power
4 10:45 - 11:15	**10:45 - 12:45 (lunch)**	**Workshop**	Exhibits Open 9AM-3PM	Exhibits Open 9AM-3PM	Exhibits Open 9AM-3PM	Exhibits Open 9AM-3PM	Exhibits Open 9AM-3PM	EnPRO 352: System to Neutralize Remote Detonation Capabilities
5 11:15-11:45		**Workshop**	Exhibits Open 9AM-3PM	Exhibits Open 9AM-3PM	Exhibits Open 9AM-3PM	Exhibits Open 9AM-3PM	Exhibits Open 9AM-3PM	Exhibits Open 9AM-3PM
6 11:45-12:15		**Workshop**	Exhibits Open 9AM-3PM	Exhibits Open 9AM-3PM	Exhibits Open 9AM-3PM	Exhibits Open 9AM-3PM	Exhibits Open 9AM-3PM	Exhibits Open 9AM-3PM
7 12:15 - 12:45		**Workshop**	Exhibits Open 9AM-3PM	Exhibits Open 9AM-3PM	Exhibits Open 9AM-3PM	Exhibits Open 9AM-3PM	Exhibits Open 9AM-3PM	EnPRO 354: The IIT Scarlet Hawk Video Shop
8 1:00 - 1:30			IPRO 314: Electric Hybrid Car Conversion Using Ultra-Capacitor Augmentation	IPRO 304y: Alkylate-Based Detergents and Optimizing the Refinery-Petrochemical Interface	IPRO 305: Applications of Pervasive Computing	IPRO 382: Operation Kosovo	IPRO 309: Integrated Turn-Key X-Ray Fluorescence Analysis System Using Bent Laue Optics	EnPRO 355: Sports Technology for the Fans
9 1:45 - 2:15			IPRO 334: Accident Reduction at 33rd and State Street	IPRO 304z: Methods to Reduce Mercury Pollution from Power Plants	IPRO 329: Using Computer Games as a Design Platform for E-Learning Applications	IPRO 339: Benchmarking IPRO Processes and Exploring Cutting Edge Technologies	IPRO 331: Non-Invasive Blood Glucose Monitoring	EnPRO 358: Low-Cost Robotic Controller
10 2:30 - 3:00			IPRO 336: AISC Steel Bridge Competition		IPRO 372/472: Medical Informatics	IPRO 333: Creating Documentary Web Sites for IPRO Team Projects		EnPRO 361: Bus Tracker: The Original
11 3:15 - 3:45		**Keynote Speech**						
12 3:45 - 4:15		**IPRO team awards**						

Appendix 2: IPRO Project D ay Schedule, Spring 2005

Session			Track 1	Track 2	Track 3	Track 4	Track 5	Track 6
			Sustainability & Engineering Design	System Analysis, Design & Development	Health Care & Biotechnology	Learner-Driven Education Projects	Information Design & the User Experience	New Venture Analysis & Business Planning
			Lower Level			Main Level		
			Trustees Dining Room	Room 007	Armour Dining Room	Ballroom -- East	Hermann Lounge	Alumni Lounge
8:30 - 9:30			Orientation Breakfast for Judges (Ballroom -- West)					
1	9:30 to 10:00	Exhibits (Collaboratory+Gallery+Lobby)	IPRO 301 Sustainable Village	IPRO 304B Polyethylene Process Design & Economics and Catastrophic Explosion Analysis	IPRO 331 Non-Invasive Blood Glucose Monitoring	IPRO 316 Advancing Robotics Experiences at IIT	IPRO 333 Creating a Video Documentary of the IPRO Experience and Enhancing the GradNet Web Site	IPRO 351 Virtual Reality: Development of an Advanced Immersive Visualization Environment at IIT
2	10:15 to 10:45		IPRO 304A Solar/Wind Hydrogen Fueling Station Design	IPRO 307 Automating Shipping Container Transfer in Chicago	IPRO 340 Improving Health Care Information Systems in a Community Health Service Network	IPRO 329 Edutainment: Designing & User Testing an E-Learning Museum Game	IPRO 303 Research, Education & the Arts: Creating an Exhibit for the Atrium at Fermilab	IPRO 356 Commercial Potential of IIT Mercury Pollution Prevention Technology
3	11:00 to 11:30		IPRO 320 The Greenhouse Project	IPRO 309 Integrated Turn-Key X-Ray Fluorescence Analysis System Using Bent Laue Optics	IPRO 302 Synthetic Biology: Engineering Novel Organisms	IPRO 308 Projects that Serve the Needs of Tsunami Victims and Relief Organizations	IPRO 306 Conceptual Design & Planning for a Digital Art Façade for the New Hyde Park Art Center	IPRO 350 Kaplan Fellows SkyBlue Mobile Cell Phone Application Business Plan
4	11:30 to 1:00	Exhibits & Lunch	Exhibits (IPRO Team Collaboratory + Gallery Lounge + Main Lobby) Lunch (Ballroom -- West)					
5	1:00 to 1:30	Exhibits (Collaboratory+Gallery+Lobby)	IPRO 335 The Interprofessional Approach to Architectural Engineering Capstone Design	IPRO 312 Information Systems Analysis & Development	IPRO 304C Development of a Portable Method for Preparing Previously Frozen Red Blood Cells for Transfusion	IPRO 338 Building & Implementing a Knowledge Management System	IPRO 321 Social Network Analysis for Pace Suburban Bus Stakeholders	IPRO 352 US EPA Design Competition for Sustainability: The Market Potential for Recycled Tire Material
6	1:45 to 2:15		IPRO 326 Hybrid Electric Vehicles: Simulation, Design & Implementation	IPRO 325 Real-Time Automated Video Tracking/Recording for Skydiving & Other Sports	IPRO 341 Developing a Prototype Cardiovascular Display for the Prenatal-to-Newborn	IPRO 339 Assessing & Improving Interprofessional Education at IIT	IPRO 330 Design and Development of a Novel On-Line Music Distribution Site	IPRO 353 The Peppy Robot
7	2:30 to 3:00		IPRO 371 Sustainable Landscape Design & Implementation at the Rice Campus	IPRO 305 Applications of Pervasive Computing		IPRO 310 Hosting the 2005 ASCE Great Lakes Regional Conference at IIT	IPRO 311 Using the IIT Intranet Mediator to Support the US Holocaust Memorial Museum	
8	3:15 to 5:00	Closing Ceremonies (Ballroom)	Closing Ceremonies (Ballroom)					
			"Integrating Technology & Business to Achieve Entrepreneurial Success" *A Thought Leader Seminar sponsored by the Institute of B*					
			IPRO Teamwork Recognition Awards					
			Reception					

Appendix 3: Descriptions of IPRO Projects

Section: Spring 2006- 301
Title: Back to the House of the Future
Sponsor:
Faculty: Said Al-Hallaj (CHE) (alhallaj@iit.edu or 312.567.5118) in collaboration with Chuck Owen (ID), Frank Flury (ARCH) and faculty from various other academic units
Appropriate Disciplines: Architecture, business, computer science, design, engineering (architectural, chemical, civil, computer, electrical, materials, mechanical), political science, psychology, information technology, manufacturing technology, technical communication
Description: This project will advance the work of previous IPRO teams that developed a business plan that outlines the project's mission, scope, revenue sources, marketing plan and timeline. The team will also benefit from House of the Future concepts developed at the Institute of Design in the 1980's. The Spring 2006 House of the Future IPRO team will develop and prototype one or more adaptable building concepts, i.e., a set of system building blocks or "kit" that can offer extreme flexibility in creating a "living laboratory" that evolves over time in response to the ever-changing opportunities associated with serving our needs through the human habitat.

The work of this team will lead to a specification requirements document that can guide subsequent site selection, conceptual and schematic design, and engineering phases, as well as attract innovation partners from industry, foundations, government and other academic institutions. This may also lead to a design competition. The vision of the Sustainable Village is to create a dynamic demonstration project showcasing the "House of the Future," a hydrogen fueling station, and hydrogen-powered vehicles. Embedded in all layers of the project will be an interactive academic and community outreach program. Sustainable Village will create a knowledge base that will guide stakeholders to create a more sustainable society. The "House of the "Future" will be constructed as a living laboratory with removable walls and components to test the environmental impact of materials and appliances. It will be powered by clean energy, including a hydrogen fuel cell, solar and wind technologies. This concept anticipates a world where stationary and transportation fuels are interchangeable and thus the hydrogen produced at the hydrogen fueling station will supply fuel for the house and for zero-emission vehicles including a campus shuttle bus.

A balanced team of students representing architecture, design, engineering and other fields is highly desired due to the broad scope and opportunity for creativity that this project offers.

Meeting Day/Time: The above IPRO 301 is scheduled for Tuesdays and Thursdays from 5:00 to 6:15 pm.

Section: Spring 2006- 302
Title: Synthetic Biology: Engineering Novel Organisms
Sponsor: IIT Collaboratory for Interprofessional Studies
Faculty: Nick Menhart (BCPS) (menhart@iit.edu or 312.567.3123
Appropriate Disciplines: Design, computer science, computer information systems, engineering (biomedical, chemical, computer, electrical), math and science education, science (biology, chemistry, molecular biochemistry and biophysics, physics)
Description: This problem lies at the interface of genomics and design, and is being considered by many leading researchers and institutions. Essentially, it attempts to make sense of the vast amount of data that has come out of our ability to sequence the human and other genomes, and figure out what all that data means. Although we have made great progress at understanding the individual pieces of genetic information – a reductionist view point – that knowledge has shed relatively little light on how the systems that are living organisms function. In sum, we are attempting to learn how these systems function by putting together simple ones and seeing if we can manipulate them in meaningful and predictable ways.

The overarching team goal is to develop a synthetic biological structure that does something interesting, useful and novel. Our initial target was an incremental improvement on a three state biological oscillator that produced blinking bacteria. This is now very nearly realized, and hope to have it completed by Fall 2005 IPRO Projects Day. A major design goal of this team (being conducted concurrent with this semester's implementation of previously described targets) is the design of a "synchroscillator" system previously theoretically discussed, but never realized in practice that can synchronize such a system through the use of quorum sensing molecules (a.k.a. bacterial hormones); as well as the design of a system to move this flashing behavior to a macroscopic animal model (zebrafish). The synchroscillator would have important practical applications in fermentation technology, while the zebrafish example would allow us to move into organisms more like ourselves – as well as being very visually arresting (the fish would change color on an hourly time scale)

Major activities encompass design, biology and computation: A major untapped potential of this project is the design aspect, which controls the overall direction we will proceed. The design target is developed in conjunction with feasibility analyses of the computational and biological teams, but is at the outset a creative process that relies upon imagining what type of system are even possible. The target design is currently a three-state oscillator, with a synchronization module being developed. Other possibilities involve environmental sensing or biological computing. The biological aspects of this work will involve the application of modern genetic engineering techniques to create the designed organism. This involves the physical manipulation and modification of DNA sequences from a number of organisms, and their incorporation into our genetic circuit. The computational effort will center on the elaboration of our simulation system that can analyze the interactions of the individual biological elements in the system, and predict and model the behavior of the system a whole. Currently, our model has been developed in MATLAB, although we are in the process of porting it to an open-source environment.

The Fall 2004 team developed the conceptual framework and initial target design specifications. A basic modeling environment in MATLAB

was developed, and genetic elements were procured and modified to specifications. The Spring 2005 team captured the genetic pieces within biological systems and assembly work was begun. However certain bottlenecks in assembly were encountered, which were resolved over the summer by the development of a new assembly process that is being implemented by the Fall 2006 team. This team is also designing second-generation targets that will be more complex and more compelling. The initial focus of the Spring 2006 team will be to implement second-generation targets within a synchronized system (since bacteria are too small to be seen easily individually, and more importantly, since a whole group of synchronized bacterial can do more useful things than a single bacterium acting alone (i.e. in fermentation processes). A second target being considered is the production of a macroscopically observable system in a higher organism, e.g., a fish.

Meeting Day/Time: The above IPRO 302 is scheduled for Tuesdays from 10:00 to 11:15 am and Fridays from 11:00 to 11:50 am.

Section: Spring 2006- 303
Title: Podcasting, Market Research & Multimedia Pilots for Calamos Investments LLC
Sponsor: Calamos Investments
Faculty: Daniel Ferguson (Business and IPRO Senior Lecturer) (dmferguson@stuart.iit.edu or 312.567.3946) and Suzanne Mueller (BUS) (muellers@iit.edu or 312.567.5007)
Appropriate Disciplines: Applied mathematics, business, computer information systems, computer science, design, information technology management, internet communication, math and science education, professional and technical communication, psychology
Description: Starting in Fall 2005, Calamos is sponsoring a one-year IPRO team project that will analyze and propose alternative digital communication strategies for its different current or potential client groups. Calamos provides sophisticated financial investment products; and currently, telephone, paper and web sites are their primary client connection and information sharing tools.

A primary goal of this IPRO team is to evaluate and suggest improvements to their current digital information channels. The team will explore and demonstrate the effectiveness of new digital channels or modes of information delivery with selected customer groups.

The first phase during the Fall 2005 semester focused on problem identification, evaluation of alternatives and competitive assessments. Subteams investigating the future of digital technology, the customer interface and the website were created. Each one had defined tasks and deliverables for the fall semester, culminating in an overall marketing/communications strategy recommendation for Calamos.

The second phase during the Spring 2006 semester will focus on design, prototyping, and demonstration of new technologies. This includes podcasting, more effective uses of multimedia video applications for their web site and related market research projects for Calamos. Students who participate in this one-year IPRO project may also have the opportunity to qualify for internships or career

employment at Calamos Investments.

Calamos Investments, located in Naperville, Illinois, is a fund manager for private clients and institutional investors lead by John P. Calamos, Sr. and Nick P. Calamos. The Calamos Growth Fund has been ranked Number One by Forbes over the past three years. John Calamos is a member of IIT's Board of Trustees and serves on the Board of Overseers of the Institute of Business & Interprofessional Studies that includes the IPRO Program. To learn more about Calamos Investments please visit www.calamos.com.

Meeting Day/Time: The above IPRO 303 is technically scheduled for Mondays/Wednesdays/Fridays from 11:00 to 11:50 am. However, the instructor and team members will actually only meet on Mondays and Wednesdays from 11:00 to 12:15, and not have class on Fridays.

Appendix 4 Survey Questions used in this analysis

Q1	While enrolled in this IPRO, I was motivated to learn more about the subject of the project.
Q2	Any member put in charge of a task understood the task and how to complete it.
Q3	My teammates were able to understand the ideas I tried to communicate to them.
Q4	The team was able to break up large complex tasks into a number of smaller easier tasks.
Q5	Opinions voiced by team members were treated with respect.
Q6	I was able to provide enough motivation to my teammates to help them complete their tasks.
Q7	Decisions were made in a way that was fair for everyone on the team.
Q8	I will retain the knowledge I have gained from participating in this IPRO project.
Q9	When my team experienced a conflict, we discussed it openly in order to solve it.
Q10	Every person in my team had the same goals/objectives in mind.
Q11	My teammates and I communicated effectively through verbal dialogue (in person or over the phone).
Q12	Each team member contributed the same amount of time toward their assigned tasks.
Q13	I believe that IPROs are beneficial to faculty.
Q14	Issues in our project were handled professionally.
Q15	I learned valuable skills through my participation in IPRO.
Q16	We set reasonable deadlines for tasks which we were able to meet.
Q17	If this IPRO were a year-long project, I would continue with my team and project until the end.
Q18	My teammates and I frequently communicated through verbal dialogue (in person or over the phone).
Q19	I believe that IPROs are beneficial to students.
Q20	My teammates and I were able to share our information with each other.
Q21	Overall, I enjoyed my IPRO experience.
Q22	I was able to lead the team in the right direction.
Q23	I have gained an appreciation for the subject of this project and I would like to explore it further.
Q24	Team members contributed to discussions.
Q25	I worked on my assigned tasks in a timely fashion.
Q26	When confusion or conflict arose, the team made sure that every member felt it had been resolved before moving on.
Q27	I was as responsible as my teammates for the outcome of the team.
Q28	We were able to complete all of our assigned tasks.
Q29	My teammates and I frequently communicated through written text (E-mail, printouts, online conversations, etc).
Q30	My teammates and I communicated effectively through written text (E-mail, printouts, online conversations, etc).
Q31	My team was satisfied with our end results.

Appendix 5: IPRO Project Exhibit Evaluation Form

The learning objectives of the IIT Interprofessional Projects (IPRO) Program include multi-disciplinary teamwork, communication, project management, real world problem solving, and a desire for life-long learning. While we appreciate that the projects vary widely in content and in their stage of development, all IPRO projects should attempt to achieve these objectives. We wish to recognize the teams that have achieved notable distinction in meeting these objectives. We welcome any additional comments, which will be shared with the IPRO faculty.

IPRO/EnPRO Project Number/Title: _____/_____

Name of Judge:_____

Please rate each criterion on a scale of 1 – 10, 1 being very low and 10 being very high. Add up **the points for each subsection and confer with your co-judges for consistency.**

I. Visual Aids

Rate from 1-10

____ The exhibit material/activity focuses on well-defined and easy to grasp project objectives.

____ The exhibit clearly presents the project methods, results and conclusions.

____ Additional exhibit activities, demonstrations, graphics, props, handouts and visuals are used effectively and communicate the project objectives and project results.

Visual aids total score: _____ /30

II. Abstract

____ Abstract is well organized, available and used in the discussion at the exhibit.

____ The project objective and outcomes are clearly stated and the project activities are summarized and team members and other contributors recognized.

Abstract total score: _____ /10

III. Communication

____ Team members are able to explain the objectives, plans, and outcomes of the project clearly.

____ Multiple team members can respond effectively to the judges' questions and engage the judges and interact with them effectively.

Communication total score: _____ /30

IV. Overall Impression

____ *Overall, the exhibit was well organized, creative, and effective in presenting a message.*
Overall Impression total score: _____ /20

V. Evidence of End of Term Deliverables (5 points each)
____ Final Report **table of contents** and/or Final Report exists **and/or**.
____ CDROM **table of contents** and/or CDROM exists.
Deliverables and table of contents total score: _____/10
TOTAL SCORE: _____/100

VI. Other observations/comments (Anonymously shared through the faculty advisor with the IPRO team to provide feedback):

Appendix 6: IPRO Project Presentation Evaluation Form

The learning objectives of the IIT Interprofessional Projects (IPRO) Program include multi-disciplinary teamwork, communication, project management, real world problem solving, and a desire for life-long learning. While we appreciate that the projects vary widely in content and in their stage of development, all IPRO projects should attempt to achieve these objectives. We wish to recognize the teams that have achieved notable distinction in meeting these objectives. We welcome any additional comments, which will be shared with the IPRO faculty.

IPRO Project Number/Title: _____/_____
Name of Judge:_____

Please rate each criterion on a scale of 1 – 10, 1 being very low and 10 being very high. Add up the points for each subsection.

I. IPRO Presentation
Rate from 1-10
____ Presents a clear, central idea in an organized manner
____ Uses visual aids effectively
____ The presentation is shared and several team members can address each question
____ Manages allotted time effectively
Presentation total score: _____ /40

II. IPRO Outcome
____ The team's objectives were clearly stated as an activity, a deliverable, or an event
____ The objectives addressed challenging real world problems
____ The objectives were reasonable to attain in the allotted time
____ The team adequately utilized the available resources
____ The team considered the broad scope of issues relevant to the project
____ The results met the team's objectives

Outcome total score: _____ /60
TOTAL SCORE: _____/100

III. Other observations/comments (Will be anonymously shared with the IPRO team to provide them feedback): _____

Appendix 7: Sample IPRO Day judges scores from Spring 2005, sorted from high to low total scores within tracks

Track 1	IPRO Description	presentation	exhibit	total
371	Sustainable Landscape Design & Implementation at the Daniel F. and Ada L. Rice Campus	92.8	94.8	187.6
301	Sustainable Village	91.3	86.4	177.7
326	Hybrid Electric Vehicles: Simulation, Design & Implementation	97.2	78.2	175.4
304B	Solar/Wind Hydrogen Fueling Station Design	79.2	94.0	173.2
320	The Greenhouse Project	76.0	79.8	155.8
335	The Interprofessional Approach to Architectural Engineering Capston Design	76.0	72.4	148.4
Track 2				
312	Information Systems Analysis & Development for PK Tool	89.5	88.8	178.3
305	Applications of Pervasive Computing	83.0	87.8	170.8
325	Real-Time Automated Video Tracking/Recording for Skydiving & Other Sports	78.7	88.3	167.0
309	Integrated Turn-Key X-Ray Fluorescence Analysis System Using Bent Laue Optics	75.0	84.0	159.0
304A	Polyethylene Process Design & Economics and Catastrophic Explosion Analysis	73.3	80.5	153.8
307	Automating Shipping Container Transfer in Chicago	71.5	79.7	151.2
Track 3				
340	Improving Health Care Information Systems in a Community Health Service Network	90.0	88.3	178.3
331	Non-Invasive Blood Glucose Monitoring	89.8	84.0	173.8
302	Synthetic Biology: Engineering Novel Organisms	80.3	84.5	164.8
304C	Development of a Portable Method for Preparing Previously Frozen Red Blood Cells for Transfusion	82.5	68.8	151.3
341	Develoing a Prototype Cardiovascular Display for the Prenatal-to-Newborn Blood Flow System	81.3	28.3	109.5
Track 4				
329	Edutainment: Design & User Testing of an E-Learning Museum Game for K-12 Math & Science Education	98.8	92.0	190.8
339	Assessing & Improving Interprofessional Education at IIT	88.5	89.0	177.5
308	Projects that Serve the Needs of Tsunami Victims and Relief Organizations	97.0	73.5	170.5
338	Building & Implementing a Knowledge Management System for the IPRO Program	77.8	86.8	164.5
310	Hosting the 2005 ASCE Great Lakes Regional Conference at IIT	73.5	66.3	139.8
316	Advancing Robotics Experiences at IIT	62.5	75.3	137.8
Track 5				
321	Social Network Analysis for Pace Suburban Bus Stakeholders	91.7	95.0	186.7
303	Research, Education & the Arts: Creating an Exhibit for the Atrium at Fermilab	92.8	86.3	179.1
311	Using the IIT Intranet Mediator to Support the US Holocaust Memorial Museum	90.0	88.3	178.3
333	Creating a Video Documentary of the IPRO Experience and Enhancing the GradNet Web Site	87.0	81.7	168.7
330	Design and Development of a Novel On-Line Music Distribution Web Site	87.0	59.3	146.3
306	Conceptual Design & Planning for a Digital Art Façade for the New Hyde Park Art Center	65.5	65.7	131.2
Track 6				
350	Kaplan Fellows SkyBlue Mobile Cell Phone Application Business Plan	84.8	92.8	177.6
356	Commercial Potential of IIT Mercury Pollution Prevention Technology	77.6	82.5	160.1
353	The Peppy Robot	72.2	82.8	155.0
351	Virtual Reality: Development of an Advanced Immersive Visualization Environment at IIT	75.2	72.3	147.5
352	US EPA Design Competition for Sustainability: The Market Potential for Recycled Tire Material	59.6	86.5	146.1

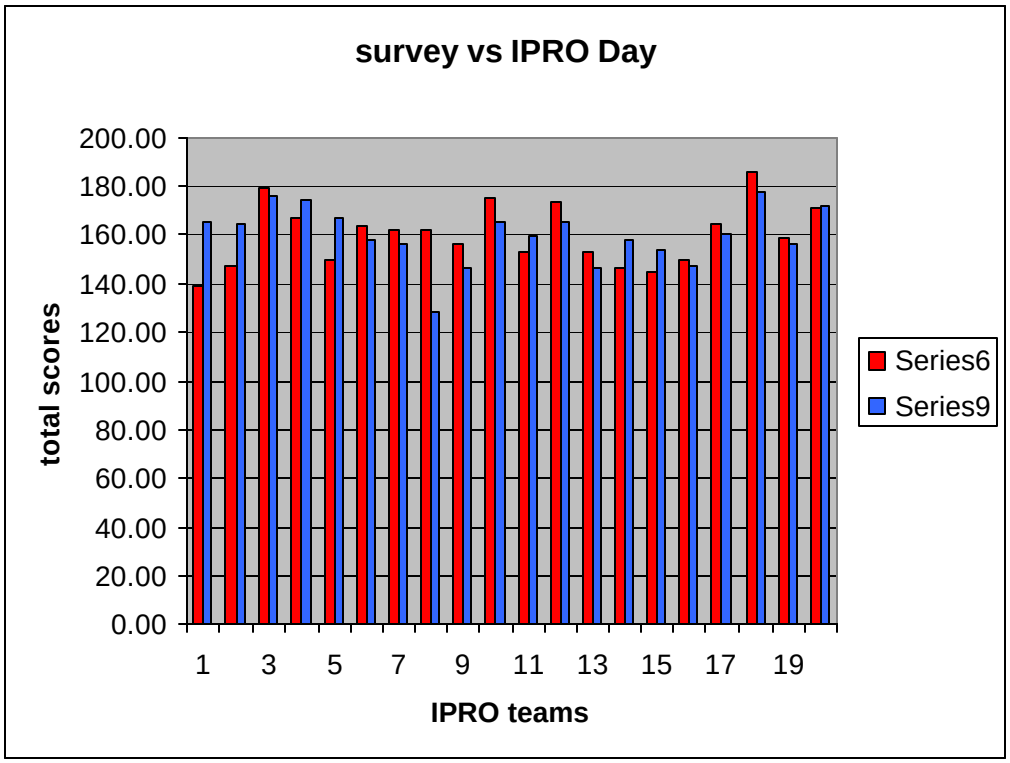
Appendix 8: Factor Scores and IPRO Judge Scores for Spring 2005

IPRO	Factor 1	Factor 2	Factor 3	Factor 4	Total	Compare	IPRO Title	Pres.	Exhibit	Total
301	3.67	3.17	3.98	3.89	14.7	147.04	Sustainable Village	91.3	86.4	177.7
302	4.46	3.48	4.05	4.12	16.12	161.15	Synthetic Biology: Engineering Novel Organisms	80.3	84.5	164.8
303	3.93	3.13	4.14	3.98	15.18	151.77	Research, Education & the Arts: Creating an Exhibit for the Atrium at Fermilab	92.8	86.3	179.1
305	4.46	4.07	4.47	4.46	17.45	174.5	Applications of Pervasive Computing	83	87.8	170.8
306	3.92	3.06	3.62	3.73	14.33	143.28	Conceptual Design & Planning for a Digital Art Façade for the New Hyde Park Art Center	65.5	65.7	131.2
307	3.81	3.21	3.86	3.53	14.41	144.07	Automating Shipping Container Transfer in Chicago	71.5	79.7	151.2
308	4.43	3.87	4.25	4.28	16.82	168.22	Projects that Serve the Needs of Tsunami Victims and Relief Organizations	97	73.5	170.5
310	4.2	3.5	4.21	3.91	15.82	158.17	Hosting the 2005 ASCE Great Lakes Regional Conference at IIT	73.5	66.3	139.8
311	4.25	4.12	4.46	4.4	17.23	172.3	Using the IIT Intranet Mediator to Support the US Holocaust Memorial Museum	90	88.3	178.3
312	3.92	3.8	4.05	4.18	15.95	159.51	Information Systems Analysis & Development for PK Tool	89.5	88.8	178.3
316	3.79	3.24	3.79	3.72	14.54	145.36	Advancing Robotics Experiences at IIT	62.5	75.3	137.8
320	3.69	3.39	4	4	15.07	150.74	The Greenhouse	76	79.8	155.8

							Project			
321	4.11	3.49	4.05	3.8	15.45	154.49	Social Network Analysis for Pace Suburban Bus Stakeholders	91.7	95	186.7
325	3.55	2.73	3.75	3.6	13.62	136.23	Real-Time Automated Video Tracking/Recording for Skydiving & Other Sports	78.7	88.3	167
326	4.4	3.98	4.44	4.32	17.15	171.45	Hybrid Electric Vehicles: Simulation, Design & Implementation	97.2	78.2	175.4
329	4.21	3.88	4.48	4.22	16.79	167.91	Edutainment: Design & User Testing of an E-Learning Museum Game for K-12 Math & Science Education	98.8	92	190.8
330	3.56	3.46	3.75	3.78	14.55	145.46	Design and Development of a Novel On-Line Music Distribution Web Site	87	59.3	146.3
331	3.35	3.32	4.05	3.89	14.61	146.1	Non-Invasive Blood Glucose Monitoring	89.8	84	173.8
333	3.64	3.35	3.98	3.83	14.8	147.99	Creating a Video Documentary of the IPRO Experience and Enhancing the GradNet Web Site	87	81.7	168.7
335	3.88	3.52	4.08	3.89	15.36	153.59	The Interprofessional Approach to Architectural Engineering Capston Design	76	72.4	148.4

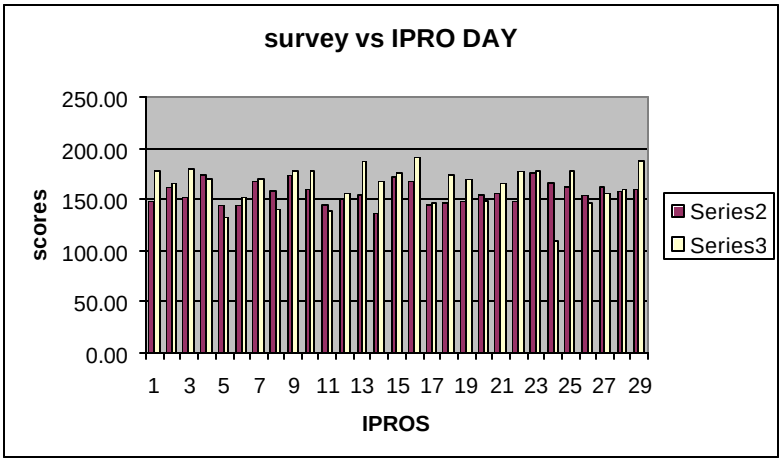
Appendix 9 : Survey vs IPRO day Results for Spring 2004

Team	F1	F2	F3	F4	SUM	compare	Presentation	Exhibit	Overall
302	2.82	3.76	3.58	3.70	13.85	138.55	83.00	82.00	165.00
303	2.99	3.65	3.73	4.38	14.73	147.31	81.40	83.33	164.73
305	4.64	4.13	4.33	4.83	17.94	179.36	84.75	91.33	176.08
307	4.22	4.00	3.73	4.75	16.70	166.96	76.50	98.25	174.75
308	3.52	3.46	3.65	4.36	15.00	149.96	85.75	81.33	167.08
316	4.13	3.86	4.02	4.38	16.38	163.78	77.60	80.00	157.60
320	4.18	4.00	4.03	4.00	16.21	162.13	82.60	73.67	156.27
322	4.11	3.80	3.78	4.50	16.19	161.92	54.00	74.33	128.33
324	3.99	3.37	3.96	4.33	15.65	156.48	82.25	64.33	146.58
329	4.37	4.00	4.31	4.86	17.54	175.40	84.67	80.33	165.00
334	3.72	3.55	3.78	4.25	15.30	152.97	74.25	85.00	159.25
338	4.53	4.12	4.24	4.50	17.39	173.89	87.33	78.33	165.67
339	3.55	3.83	3.85	4.09	15.31	153.13	67.60	78.67	146.27
352	3.42	3.17	3.65	4.42	14.65	146.53	78.67	79.00	157.67
360	3.23	3.83	3.34	4.06	14.46	144.65	74.83	79.00	153.83
361	3.66	3.17	3.65	4.50	14.98	149.79	84.17	62.67	146.83
382	3.98	3.87	3.98	4.62	16.45	164.46	75.40	85.00	160.40
304A	4.66	4.58	4.69	4.65	18.58	185.81	89.50	88.25	177.75
304B	3.97	3.52	4.04	4.31	15.83	158.34	76.25	80.25	156.50
304C	4.33	4.07	4.19	4.50	17.09	170.88	83.00	88.75	171.75



Appendix 10 : Survey vs IPRO Day results for Spring 2005

TEAM	SURVEY	IPRO DAY		DIFF	REASON
301	147.04	177.65		-30.61	FOCUS
302	161.15	164.75		-3.60	
303	151.77	179.08		-27.31	FOCUS
305	174.50	170.75		3.75	
306	143.28	131.17		12.12	
307	144.07	151.17		-7.10	
308	168.22	170.50		-2.28	
310	158.17	139.75		18.42	
311	172.30	178.25		-5.95	
312	159.51	178.25	TW	-18.74	
316	145.36	137.75		7.61	
320	150.74	155.75		-5.01	
321	154.49	186.67	TW	-32.18	FOCUS
325	136.23	167.00		-30.77	FOCUS
326	171.45	175.40		-3.95	
329	167.91	190.75	TW	-22.84	FOCUS
330	145.46	146.25		-0.79	
331	146.10	173.75		-27.65	FOCUS
333	147.99	168.67		-20.68	
335	153.59	148.40		5.19	
338	155.66	164.50		-8.84	
339	147.54	177.50		-29.96	FOCUS
340	174.92	178.25	TW	-3.33	
341	165.92	109.50		56.42	LOST
350	162.05	177.55	TW	-15.50	
352	152.34	146.10		6.24	
353	162.18	154.95		7.23	
356	156.26	160.10		-3.84	
371	159.73	187.63	TW	-27.91	FOCUS



Appendix 11: Item mapping to factors across semesters, Items with no overlap

Questions that have no overlap between Spring 04, Fall 04 and Spring 05.

For example, Q 3 loads on factor 2 in Spring 04 however it loads on Factor 3 in Fall 04 and Spring 05.

Spring 04			
Factor 1	Factor 2	Factor 3	Factor 4
	Q3		
	Q4		
	Q5		
	Q6		
	Q7		
		Q9	
	Q11		
Q13			
Q14			
	Q16		
		Q22	
		Q24	
		Q25	
		Q26	
		Q27	
Q28			
			Q29
			Q30
Q31			

Fall 04			
Factor 1	Factor 2	Factor 3	Factor 4
		Q3	
	Q4		
	Q5		
			Q6
	Q7		
	Q9		
		Q11	
Q13			
	Q14		
			Q16
			Q22
	Q24		
			Q25
	Q26		
	Q27		
			Q28
		Q29	
		Q30	
		Q31	

Spring 05			
Factor 1	Factor 2	Factor 3	Factor 4
		Q3	
		Q4	
			Q5
Q6			
			Q7
			Q9
		Q11	
	Q13		
			Q14
	Q16		
		Q22	
		Q24	
		Q25	
			Q26
		Q27	
	Q28		
		Q29	
		Q30	
		Q31	